

Chapter 583**Use Attainment Evaluation Using Nutrient Criteria for Surface Waters**

SUMMARY: This Chapter establishes nutrient criteria for surface waters of the State. Nutrient enrichment can cause negative environmental impacts to surface waters, such as algal blooms, low dissolved oxygen concentrations, excessive growths of filamentous algae or bacteria, and generation of cyanotoxins. Methods described in this Chapter will be used to make decisions about attainment or impairment of designated and existing uses of surface waters under the State's water quality classification system. This Chapter also describes how these use attainment determinations may be used by the Department in the listing of impaired waterbodies and the establishment of nutrient discharge limits in National Pollutant Discharge Elimination System permits.

PART 1. FRESHWATER

1. Definitions. The following terms are defined for use in this Chapter.

- A. "Algal bloom" means a planktonic growth of algae that causes Secchi disk transparency to be less than 2.0 meters.
- B. "Chlorophyll *a*" means a particular kind of photosynthetic pigment of algae and plants.
- C. "Colored" means water having a mean apparent color >25 standard platinum units or equivalent value of true color or dissolved organic carbon.
- D. "Cyanotoxins" means lipopolysaccharide endotoxins, hepatotoxins, and neurotoxins produced by cyanobacteria, such as microcystin and anatoxin-a.
- E. "Diatoms" means algae in the class Bacillariophyceae.
- F. "Impounded waters" means riverine waters upstream of a dam and not classified as GPA where the surface elevation is essentially the same as found at the dam.
- G. "Ppb" means parts per billion, which is equivalent to micrograms per liter.
- H. "Ppm" means parts per million, which is equivalent to milligrams per liter.
- I. "Periphyton" means a layer of microscopic algae, bacteria, and fungi growing on a substrate within a waterbody.
- J. "Phytoplankton" means algae suspended in the water column.
- K. "Stressor" means an environmental condition of anthropogenic or natural origin that causes a detrimental change to aquatic life.
- L. "Turbid" means that the water is not clear or transparent due to small organic and inorganic particles suspended in the water.

2. **Purpose and applicability.** The purpose of this Chapter is to establish nutrient criteria used to determine impairment of a designated or existing use as described in *Water Classification Program*, 38 M.R.S.A. §§ 464(4), 465, and 465-A due to phosphorus or another nutrient. The nutrient criteria decision framework established by Part 1 of this Chapter are applicable to Class AA, A, B, C, and GPA surface waters of the State. Surface waters may be divided into segments that are evaluated independently.

NOTE: Class GPA waters must have stable or decreasing trophic state (as shown by less nutrient enrichment) as described in 38 M.R.S.A. § 465-A(1)(B). In addition, no change in land use in a watershed of a Class GPA water may result in a water quality impairment or increase in trophic state of the GPA water as described in 38 M.R.S.A. § 465-A(1)(C). These two provisions are addressed in part by Department under *Stormwater Management*, 06-096 CMR 500 (effective December 27, 2006) and by many local ordinances, both of which require certain new developments to incorporate stormwater phosphorus mitigation measures based on lake specific watershed phosphorus budgets and other provisions in "Volume II of the Maine Stormwater Best Practices Manual - Phosphorus Control in Lake Watersheds: A Technical Guide to Evaluating New Development".

3. **Nutrient Criteria Decision Framework.** The Department uses the following decision framework (Figure 1) to determine whether phosphorus or another nutrient has caused or contributed to the impairment of a designated use. The decision framework uses a variety of nutrient indicators, including total phosphorus concentrations and environmental responses of nutrient enrichment. The Department will use the decision framework to determine; (1), if there is an impaired use; and (2), if phosphorus or another nutrient caused or contributed to the impairment. The total phosphorus criteria for each class are described in Section 4 of this Chapter. Environmental response criteria for each class are described in Section 5 of this Chapter. The criteria and decision framework are also used in evaluations of existing uses for antidegradation purposes pursuant 38 M.R.S.A. § 464(4)(F).
- A. **Not impaired - all nutrient criteria are attained.** If the mean total phosphorus concentration is less than or equal to the limit of the assigned class from Table 1 and all environmental response criteria that are measured in a waterbody attain the limits of the assigned class of Table 2, then the Department will conclude that phosphorus has not caused an impairment of a use (Box 1 in Figure 1).
- B. **Not impaired - total phosphorus exceeds the limit but environmental response criteria are attained.** If the mean total phosphorus concentration is greater than the limit of the assigned class from Table 1, but all environmental response criteria that are measured in a waterbody attain the limits of the assigned class of Table 2, then the Department will conclude that phosphorus has not caused an impairment of a use (Box 2 in Figure 1). Given the potential for total phosphorous concentrations in excess of the limits assigned in Table 1 to cause or contribute to downstream water quality impacts even if they do not do so in the monitored segment, the Department subsequently may monitor downstream waterbodies for adverse effects.
- C. **Impaired - total phosphorus is less than or equal to the limit but one or more environmental response criteria are not attained.** If the mean total phosphorus concentration is less than or equal to the limit of the assigned class from Table 1, but one or more environmental response criteria that are measured in a waterbody do not attain the limits of the

assigned class of Table 2, then the attainment result is impaired with indeterminate cause (Box 3 in Figure 1). Indeterminate results require additional evaluation and best professional judgment to make the final determination. The Department will use a weight-of-evidence approach to determine if total phosphorus or another nutrient caused or contributed to an impairment of a use.

- (1) The Department will conclude that total phosphorus caused or contributed to an impairment of a use if it is shown through weight-of-evidence that phosphorus is a plausible cause.
- (2) The Department will conclude that another nutrient, such as nitrogen or carbon, has caused or contributed to an impairment of a use if it is shown through weight-of-evidence that the nutrient is a plausible stressor responsible for the impairment.
- (3) The Department will conclude that the impairment was caused by a non-nutrient stressor if it is shown through weight-of-evidence to be the primary cause responsible for the impairment.
- (4) The Department will conclude that the cause of impairment is indeterminate if there is insufficient information and more data collection is necessary to determine the cause of impairment.

D. Impaired - total phosphorus exceeds the limit and one or more environmental response criteria are not attained. If the mean total phosphorus concentration is greater than the limit of the assigned class from Table 1, and one or more environmental response criteria that are measured in a waterbody do not attain the limits of the assigned class of Table 2, then the Department will conclude that phosphorus has caused or contributed to an impairment of a use (Box 4 in Figure 1).

E. Atypical situations. The Department will use best professional judgment to interpret decision framework outcomes and make a final determination when natural conditions have contributed to elevated nutrient levels or atypical environmental responses, such as unusual periods of drought or flood, or proximity to unimpaired wetlands, lake outlets, tidal areas, or naturally occurring concentrations of fish or wildlife.

4. **Total phosphorus criteria (ppb).** The total phosphorus criteria for each statutory class are set forth in Table 1. Total phosphorus can either be measured as the mean of an established set of samples or determined using the Diatom Total Phosphorus Index (DTPI), which is computed using the protocols described in "Protocols for Calculating the Diatom Total Phosphorus Index (DTPI) and Diatom Total Nitrogen Index (DTNI) for Wadeable Streams and Rivers" (DEPLW-0970A) dated December 1, 2009. If total phosphorus measurements are inconclusive because of lab error, lost samples, etc., then potential attainment results would be limited to either Box 1 or Box 3 in Figure 1.
5. **Environmental response criteria.** The following environmental responses of nutrient enrichment indicate an impairment of a use described in 38 M.R.S.A. §§ 464(4), 465, and 465-A. A variety of environmental responses are necessary because of the variety of surface waters in Maine. The Department samples and evaluates one or more of the most appropriate environmental responses from this section and Table 2 depending on the type of surface water being sampled.
 - A. Secchi disk depth (meters).** This variable is an indicator of phytoplankton blooms and relates to designated uses and criteria in 38 M.R.S.A. § 465-A(1)(B) and the recreation and aquatic life components of § 465-A. Summer (June 1 – September 30) algal blooms usually are dominated

by cyanobacteria; however they may also be dominated by other types of algae. This variable is attained if the Secchi disk depth is (1) greater than or equal to 2.0 meters for waterbodies greater than or equal to 2.0 meters deep or (2) equal to the depth of the waterbody for waterbodies less than 2.0 meters deep (Table 2). Secchi disk depth measurements are restricted to still or slow moving waters in which water velocity does not substantially interfere with the measurements. If the water is colored or turbid because of non-algal particles, Secchi disk depth must be accompanied by chlorophyll *a* samples to confirm that algae caused non-attainment conditions.

- B. Water column chlorophyll *a* (ppb).** This variable is an indicator of phytoplankton blooms and relates to designated uses and criteria in 38 M.R.S.A. § 465-A(1)(B) and the habitat, recreation, and aquatic life components of 38 M.R.S.A. §§ 464(4) and 465. This variable is attained if the water column chlorophyll *a* concentration is less than or equal to the limit set forth in Table 2 for the statutory class of the waterbody. In addition, concentrations of cyanotoxins above appropriate health guidelines for recreational exposure are evidence of exceedance of nutrient criteria.
- C. Percent cover of algae.** This variable indicates the amount of algae growing on substrates on the bottom of a stream or river and relates to the designated uses and narrative criteria associated with habitat, recreation, and aquatic life in 38 M.R.S.A. §§ 464(4) and 465. This variable is attained if the percent of substrate covered by filamentous algae and periphyton mats greater than 1 millimeter thick is less than or equal to the limit set forth in Table 2 for the statutory class of the waterbody.
- D. Patches of fungi and filamentous bacteria.** This variable indicates major shifts in trophic state and relates to the designated uses and narrative criteria associated with habitat, recreation, and aquatic life in 38 M.R.S.A. §§ 464(4) and 465. This variable is attained if there are no macroscopically observable patches of fungi and filamentous bacteria on the substrate, excluding iron and manganese bacteria.
- E. Dissolved oxygen concentrations (ppm).** This variable protects fish and other aquatic life. This variable is attained if the waterbody attains the dissolved oxygen criteria as described in 38 M.R.S.A. §§ 465 and 465-A.
- F. pH.** This variable protects fish and other aquatic life and relates to designated uses and criteria associated with aquatic life as described in 38 M.R.S.A. §§ 465 and 465-A. Very acidic or alkaline water can be harmful to aquatic life and can be caused by nutrient enrichment. This variable is attained if the waterbody is within the range of pH, 6.0 – 8.5, or as naturally occurs.
- G. Aquatic life use attainment.** This variable is an indicator of the condition of aquatic biological communities. This variable is attained if the waterbody attains the narrative and numeric aquatic life use criteria as described in 38 M.R.S.A. §§ 465 and 465-A, and where applicable *Classification Attainment Evaluation Using Biological Criteria for Rivers and Streams*, 06-096 CMR 579 (Effective May 27, 2003).

6. Data requirements

- A. Responsibility for sampling.** In general, it is the responsibility of the Department, or its agents, to conduct sampling for the purpose of making decisions on the attainment of designated uses or maintenance of existing uses. In some circumstances, the Department requires an applicant or

holder of a waste discharge license, water quality certification, or other Department issued permit to conduct sampling of effluent or ambient conditions. The decision by the Department to require monitoring is based on the classification goal of the water, attainment status, existing water quality information, past performance of existing controls for point and nonpoint sources of pollution, and the nature, magnitude, and variability of the activity relative to the affected water. Sampling must be performed by qualified persons; the Department can provide training of Department standard operating procedures. Outside entities shall submit sampling plans to the Department and receive approval from the Department before collecting data.

NOTE: All data collection will follow Department standard operating protocols and quality assurance procedures.

- B. Routine sampling.** Routine sampling takes place during the summer months (June 1 – September 30) for streams and rivers and ice free months (May 1 – October 31) for lakes, with exceptions for special circumstances. Routine phosphorus samples will not be taken during or soon after storms or flood events. The Department will use best professional judgment and accepted statistical practices to determine the amount of phosphorus data necessary to make an attainment decision. Fewer data may be required if data are consistent and provide clear indications of condition. More data may be required if the data are greatly variable, provide conflicting information, contrary to other observations, or are near phosphorus and environmental response criteria limits.
- C. Special circumstances.** When routine sampling procedures are not ecologically appropriate or when sampling is necessary outside of the routine sampling period, a quantitative sampling and analysis plan must be developed in accordance with methods established in the scientific literature that are appropriate for the habitat conditions of the sample site or time of year.
- D. Data quality.** The Department evaluates data quality and sufficiency before making use attainment decisions. The Department evaluates the data quality, ensures that data are representative of ambient conditions, and identifies potential circumstances of atypical natural conditions as described in Section 3(E) of this Chapter. Data from outside sources are used if the Department determines them to be of sufficient quantity and quality. Additional sampling may be required after the Department reviews data quality and sufficiency.
- 7. Listing impaired waterbodies.** When phosphorous enrichment is accompanied by another stressor that contributes to an impaired use, the Department uses best professional judgment when listing the primary causes of impairment in the biennial Integrated Water Quality Monitoring and Assessment Report (Federal Clean Water Act §§ 305(b), 303(d), and 314). The Department may list another cause of impairment if the Department determines that another stressor is the primary cause of impairment and taking steps to reduce that stressor is an appropriate means of restoring designated uses. The Department may reevaluate any such decision and subsequently list phosphorus as the cause of impairment if impaired uses are not restored. The listing methodology for the Integrated Water Quality Monitoring and Assessment Report is available for review during the public comment period of each report.
- 8. NPDES permit limits.** The Department may incorporate phosphorus, nitrogen, or carbon limits in National Pollutant Discharge Elimination System (NPDES) permits after evaluating the relative

contributions of point and non-point sources in the contributing watershed and determining that permit limits for a discharge are necessary to ensure attainment of water quality standards. Carbon limits may be in the form of limits of total suspended solids or biochemical oxygen demand. In the absence of site specific models, the Department may use phosphorus concentrations in Table 1 to establish appropriate permit limits. The Department may reevaluate, and subsequently reduce, permit limits if it is determined that the phosphorus concentrations in Table 1 are insufficient to ensure attainment of water quality standards.

A. Discharge limits. The Department incorporates phosphorus, nitrogen, or carbon (in the form of organic material) discharge limits in NPDES permits in the following circumstances.

- (1) **Impaired because of nutrients.** Phosphorus, nitrogen, or carbon are found to cause or contribute to an impairment of a receiving waterbody as described in Section 3(C) or 3(D) of this Chapter and the discharge limit is necessary to bring a waterbody back into attainment of use.
- (2) **Antidegradation.** Discharge limits are necessary to ensure compliance with the antidegradation provisions pursuant to 38 M.R.S.A. § 464(4)(F).

B. Options for discharge limits. The Department may establish discharge limits for organic material, such as total suspended solids or biochemical oxygen demand, as alternatives to phosphorus limits if organic enrichment accompanies phosphorus enrichment and controlling organic enrichment is an appropriate means of restoring or maintaining water quality standards. If water quality standards are not attained after establishing limits, the Department may reevaluate the permit and may subsequently require phosphorous limits.

Figure 1. Decision framework.

	Total phosphorus concentration is less than or equal to the limit in Table 1	Total phosphorus concentration is greater than the limit in Table 1
All measured environmental response criteria meet limits in Table 2	Box 1. Not Impaired. Phosphorus did not cause an impairment of a use.	Box 2. Not Impaired. Phosphorus did not cause an impairment of a use.
One or more measured environmental response criteria do not meet limits in Table 2	Box 3. Impaired. Indeterminate cause requiring additional analysis to determine cause.	Box 4. Impaired. Phosphorus did cause or contribute to an impairment of a use.

Table 1. Total phosphorus limits either computed by the Diatom Total Phosphorus Index (DTPI) or measured as an average of water samples.

Statutory Class	Total Phosphorus Limit (ppb)
AA and A	≤ 18.0
B	≤ 30.0
C	≤ 33.0
GPA	≤ 15.0

Table 2: Environmental response criteria.

Statutory Class	AA/A	B	C	Impounded A	Impounded B	Impounded C	GPA Not colored	GPA colored
Secchi Disk Depth (meters) ^{a, b}	≥ 2.0	≥ 2.0	≥ 2.0	≥ 2.0	≥ 2.0	≥ 2.0	≥ 2.0	≥ 2.0
Water Column Chl <i>a</i> (µg/L, parts per billion)	≤ 3.5 ^a (≤ 5.0 ^{a, c})	≤ 8.0 ^a	≤ 8.0 ^a	≤ 5.0 ^{a, d}	spatial mean ≤ 8.0 ^d and no value > 10.0 ^d	spatial mean ≤ 8.0 ^d and no value > 10.0 ^d	≤ 8.0 ^{a, e}	≤ 8.0 ^{a, e}
Percent of Substrate Covered by Algal Growth ^a	≤ 20.0	≤ 25.0	≤ 35.0	--	--	--	--	--
Patches of Bacteria and Fungi ^a	None observed	None observed	None observed	None observed	None observed	None observed	--	--
Dissolved Oxygen (mg/L, parts per million) ^a	See 38 M.R.S.A. § 465						--	--
pH ^a	6.0 – 8.5							
Aquatic Life ^a	See 38 M.R.S.A. § 465 and where applicable <i>Classification Attainment Evaluation Using Biological Criteria for Rivers and Streams</i> , 06-096 CMR 579 (Effective May 27, 2003)						See 38 M.R.S.A. § 465-A	

a - Can be based on single sample following standard protocols and quality control.

b - This variable is attained if the Secchi disk depth is 1) greater than or equal to 2.0 meters for waterbodies greater than or equal to 2.0 meters deep or 2) equal to the depth of the waterbody for waterbodies less than 2.0 meters deep. If the water is colored or turbid because of non-algal particles, Secchi disk depth shall be accompanied by chlorophyll *a* samples to confirm nonattainment condition.

c - Applicable to low gradient, slow flowing Class A and AA waters.

d - Chlorophyll *a* samples from impoundments are collected using depth-integrated, photic-zone cores or depth-integrated, epilimnetic cores.

e - GPA chlorophyll *a* samples are collected using depth-integrated, epilimnetic cores.

PART 2. ESTUARINE AND MARINE WATERS

NOTE: The Department intends to add criteria to Part 2 of this Chapter at a future date to protect and maintain designated and existing uses of Class SA, SB, and SC waters as described in *Standards of Classification of Estuarine and Marine Waters*, 38 M.R.S.A. § 465-B.

9. Estuarine and Marine Nutrient Criteria. Reserved

AUTHORITY: 38 M.R.S.A §§ 341-D(1-B) and 464(5)
EFFECTIVE DATE: